

APPENDIX B.5 UPPER WABASH SERVICE AREA

ELEMENT 1. SERVICE AREA DESCRIPTION



The Upper Wabash Service Area (SA) is located in northern Indiana and is composed of the following seven 8-digit HUCs:

- 05120106 - Tippecanoe
- 05120105 - Middle Wabash-Deer
- 05120107 - Wildcat
- 05120104 - Eel.
- 05120101 - Upper Wabash
- 05120102 - Salamonie
- 05120103 - Mississinewa

The Upper Wabash SA includes all or portions of twenty-eight Indiana counties listed below and is located primarily in the Central Till Plain physiographic region.

| | | |
|-----------|------------|------------|
| Kosciusko | Tipton | Fulton |
| Noble | Clinton | Cass |
| Whitley | Tippecanoe | Carroll |
| Allen | Benton | Howard |
| Adams | White | Miami |
| Jay | Jasper | Wabash |
| Randolph | Pulaski | Huntington |
| Blackford | Starke | Grant |
| Delaware | Marshall | Wells |
| Madison | | |

The Upper Wabash SA is the largest of the eleven SAs having an area of 6,915 square miles; this area accounts for over 22% of the entire state of Indiana. The SA is located primarily in the Eastern Corn Belt Plains ecoregion; the eastern portion is within the Clayey, High Lime Till Plains sub-region and is characterized by soils which are less productive and more artificially drained than the western portion of the SA located in the Loamy, High Lime Till Plains sub-region. The Loamy, High Lime Till Plains area is characterized by soils that developed from limy, loamy, glacial deposits. Currently, both sub-regions

are dominated by corn, wheat, soybean, and livestock farming. The northwestern-most portion of the SA is located in the Northern Indiana Drift Plains ecoregion; the land is flat to rolling and is characterized by its dunes, end moraines, and lacustrine deposits with its tributaries being fed by a significant amount of groundwater. In addition, the northernmost portion of the SA is characterized by pothole lakes, ponds, marshes, bogs, and clear streams; the area is dominated by corn, soybean, and livestock farming (U.S. EPA: Ecoregions of Indiana).

Primary rivers flowing through the Upper Wabash SA are the Wabash River and its many tributaries, including the Mississinewa, Eel, Tippecanoe, White, and Vermilion Rivers as well as Sugar Creek and Wildcat Creek. The Wabash River originates as a drainage ditch in Ohio and enters Indiana in Jay County. It flows northwest towards the Little Wabash River near Huntington County and continues west and converges with the Eel River in Cass County. An additional confluence of this river occurs in Tippecanoe County with the Tippecanoe River; from here, the Wabash River flows through the Middle Wabash SA in Tippecanoe County and eventually confluences with the Ohio River in the southwestern part of the state.

Based on the 2011 NLCD, the land cover type with the most area in the Upper Wabash SA is agricultural land use (79.8%), followed by developed and impervious land use (8.6%), forest (8.6%), and wetlands and open water (1.84%) (Homer, et al., 2015). Woody wetlands are the prominent wetland type and range from approximately 0.64% per the 2011 NLCD to 2.13% per the NWI. Emergent herbaceous wetlands range from 0.32% per the 2011 NLCD to 0.78% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Upper Wabash SA have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Upper Wabash SA from 2009 – 2015 was collected and analyzed (**Table 55**). According to the data, 38 acres of impacted wetlands and 29,026 linear feet of impacted streams required mitigation in the seven year time period.

The transportation and service corridor work type accounted for the most stream impacts (86.4%), followed by development (8.26%), dam related activities (3.45%), agricultural land uses (1.72%), and energy production and mining (0.17%).

Dam related activities accounted for the most wetland impacts (56.82%), followed by development (28.34%), transportation and service corridors (14.53%), and energy production and mining (0.32%). Based on the 404 permitted impact data provide by the Corps, agricultural land uses had no

documented federally jurisdictional impacts requiring mitigation within this time period. Locations of the permitted stream and wetland impacts are provided in **Figure 65**.

| Work Type Category | Authorized Stream Impacts – Linear Feet | Percent of Stream Impact per Category | Authorized Wetland Impacts - Acres | Percent of Wetland Impact per Category |
|---------------------------|--|--|---|---|
| Agriculture | 500 | 1.72% | 0 | 0.00% |
| Dam | 1,000 | 3.45% | 21.6 | 56.82% |
| Development | 2,397 | 8.26% | 10.8 | 28.34% |
| Energy Production | 50 | 0.17% | 0.12 | 0.32% |
| Transportation | 25,079 | 86.40% | 5.5 | 14.53% |
| Grand Total | 29,026 | 100.00% | 38 | 100.00% |

Table 55. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015

Source: USACE Louisville and Detroit Districts

Upper Wabash Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

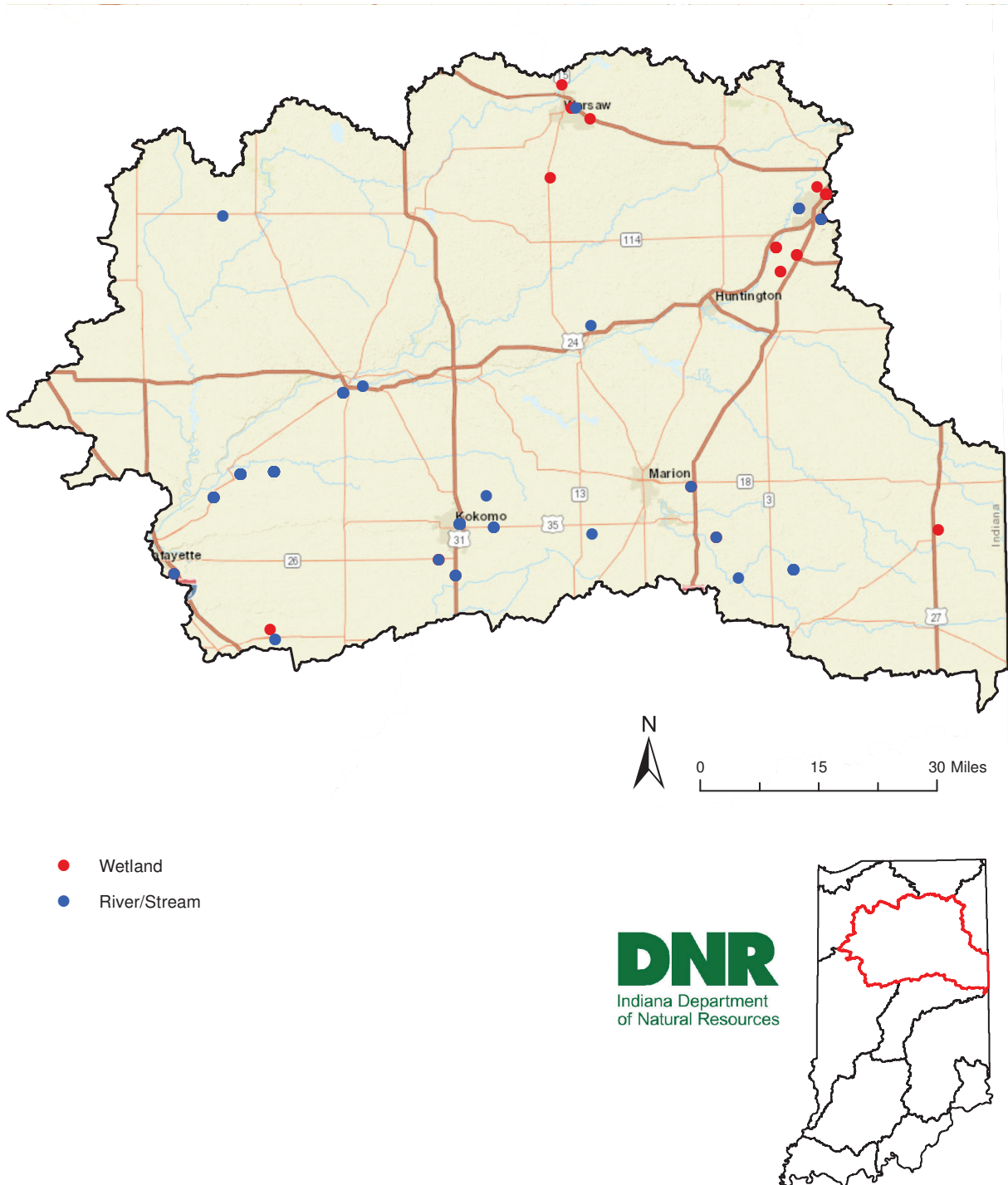


Figure 65. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Upper Wabash SA is presented in **Figure 66**, and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

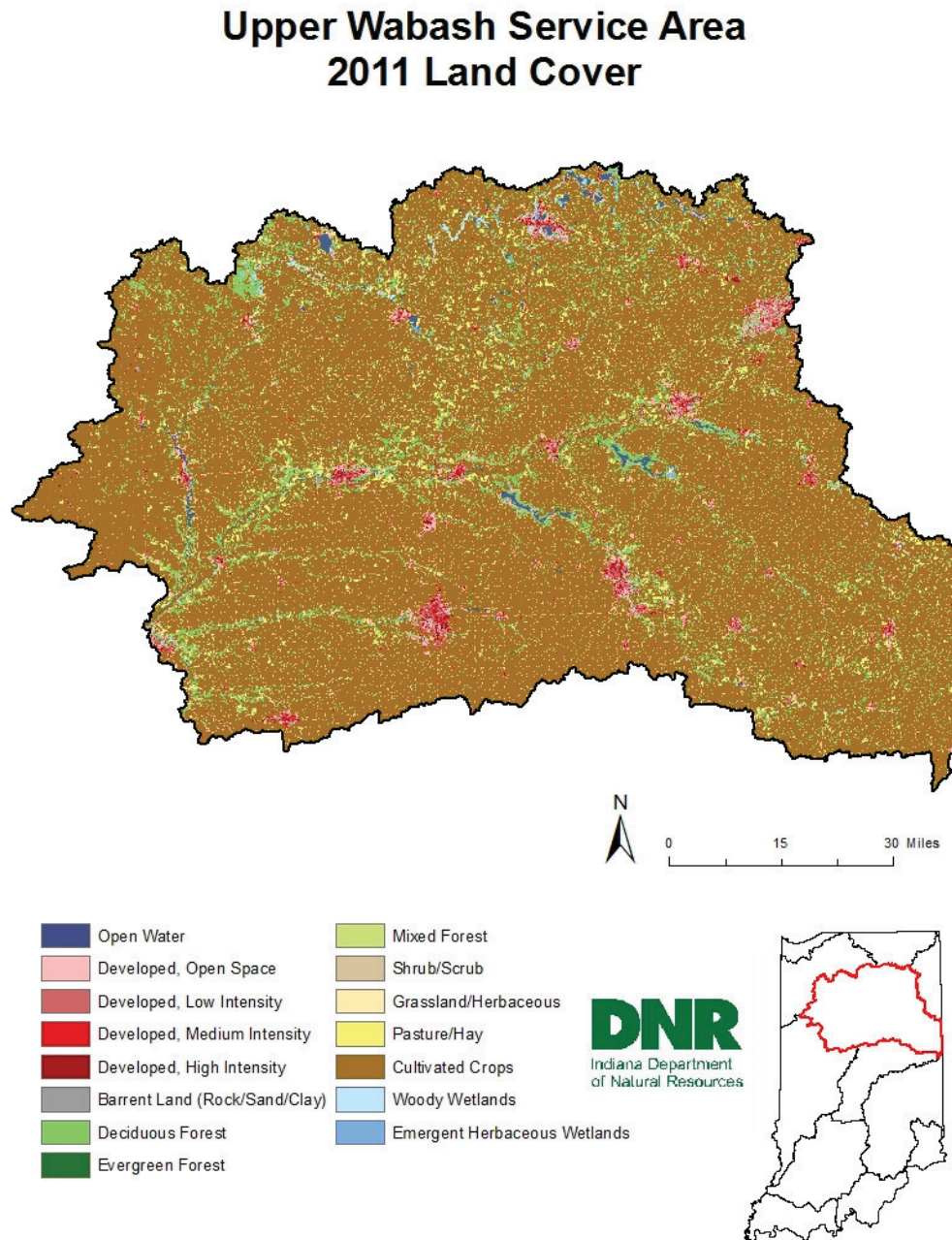


Figure 66. Land cover within the Upper Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification (**Table 56**).

| Land Cover | | | |
|--------------------------------|---------------------|------------------|------------------------|
| Class | Value | Sum of Acres | Percent of Total Acres |
| Open Water | * | 39,035 | 0.88% |
| Developed | Open Space | 250,741 | 5.67% |
| Developed | Low Intensity | 94,193 | 2.13% |
| Developed | Medium Intensity | 24,516 | 0.55% |
| Developed | High Intensity | 10,971 | 0.25% |
| Barren Land (Rock/Sand Clay) | * | 3,349 | 0.08% |
| Forest | Deciduous | 376,337 | 8.50% |
| Forest | Evergreen | 3,010 | 0.07% |
| Forest | Mixed | 8 | 0.00% |
| Shrub/Scrub | * | 13,414 | 0.30% |
| Grassland/Herbaceous | * | 36,902 | 0.83% |
| Pasture/Hay (Agriculture) | * | 111,367 | 2.52% |
| Cultivated Crops (Agriculture) | * | 3,418,747 | 77.26% |
| Wetlands | Woody | 28,202 | 0.64% |
| Wetlands | Emergent Herbaceous | 14,285 | 0.32% |
| Grand Total | | 4,425,076 | 100.00% |

Table 56. Upper Wabash land cover classification/value percentages from 2011 National Land Cover Database
 * Class does not have additional values. (Homer, et al., 2015)

IDNR combined the values within the same land cover classification in **Figure 66** below to demonstrate the current overall land cover distribution of the SA.

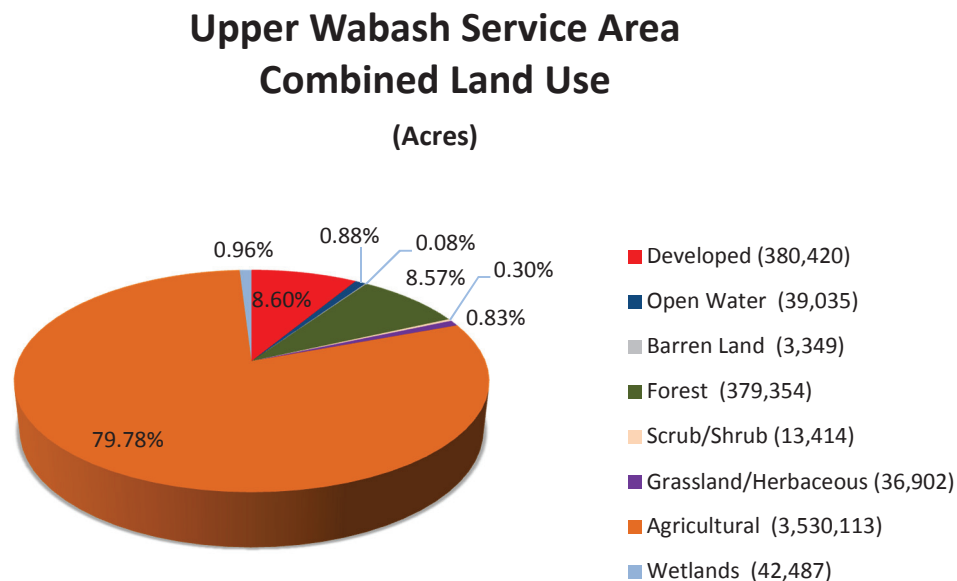


Figure 66. Combined land uses within the Upper Wabash SA from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the Upper Wabash SA. Total agricultural land use covers approximately 80% of the SA's total land area of 3,530,114 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of a few developed areas, such as Kokomo, Marion and the western portion of Ft. Wayne.

Within the identified land use areas, cultivated crops cover 3,418,747 acres (77.26%) and pasture/hay lands cover 111,367 acres (2.52%) of the SA (Homer, et al., 2015). Corn production is the primary cultivated crop followed by soybeans when based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Upper Wabash SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. Since the Upper Wabash SA is the largest with approximately 4,425,075 acres and it contains a multitude of large farming operations. The SA contains active pig, chicken, dairy cattle and beef cattle CFOs which have a minimum of 5,000 animal units with several top producing counties have CFOs that surpass the 15,000 animal unit threshold. The Upper Wabash SA boundary contains top pork and poultry producing CFOs within the state, with Carroll County's combined pig CFOs surpassing 45,000 animal units; and poultry operations in Kosciusko and Wabash counties are two of the top four chicken producers statewide with CFOs that surpass 5,000 animal units (Thompson, 2008).

In addition to dominating pork and poultry production, the Upper Wabash SA includes Carroll, Jay and Wabash Counties which notably contain over 80 CFOs each (Thompson, 2008). The number and concentration of active CFO's within the SA surpasses any other when comparing livestock production. When combining these major agricultural land use activities, the Upper Wabash SA is the top ranking with respect to percentage of total statewide agricultural land use (15.26%), and it's the most significant land use within the SA.

2.4 Growth and Development

Developed impervious area is the second largest land use category in the Upper Wabash SA. Total developed impervious land use covers approximately 380,421 (8.6%) of the 4,425,076 total acres making it the sixth most developed area by density across all of the SAs. Though this SA is sixth in developed density, it contains the second most developed land use acres of all SA's, accounting for 15% of the states approximately 2,484,939 developed acres.

In general, developed impervious areas are located along the U.S. 30 (East and West) corridor in the north consisting of communities such as Columbia City and Warsaw, and the western reaches of Ft. Wayne; along the U.S. 31 (North and South) corridor consisting of communities such as Kokomo, Peru and Rochester; and along the Wabash River and major tributaries consisting of communities such as Huntington, Wabash, Logansport and Marion. Other smaller intensely developed footprints include

communities such as Bluffton, Frankfort, Portland and eastern reaches of Lafayette. Many of the communities in the Upper Wabash SA are located adjacent to larger rivers, reservoirs and/or public freshwater lakes.

The SA contains all or part of the the following MSAs: Chicago/Gary, Fort Wayne, Lafayette-West Lafayette, Kokomo, Muncie, and Indianapolis-Carmel-Anderson, and all except the Kokomo and Muncie MSA's experienced growth during the previous decade (Manns, 2013). The core of the Kokomo MSA falls entirely within the Upper Wabash SA, where the core of the other MSA's fall mostly outside of the SA boundary. Analysis of the INDOT cities and towns GIS data shows the Upper Wabash SA contains all or part of 390 cities and/or towns, 101 of which are incorporated (INDOT, 2016). The Fort Wayne/New Haven urbanized areas have expanded into adjacent Huntington and Whitley counties in recent years primarily due to residential growth sprawling out of southwest Allen County. The total number of housing units across the region increased by 23,473 units (8.7%) from 2000 to 2010; with Whitley County accounting for the largest increase of 13.8% (Region III-A , 2015).

Eight Indiana regional councils overlap the SA and include the North Central Indiana Regional Planning Council (NCIRPC) (27%), Kankakee-Iroquois Regional Planning Commission (KIRPC) (19%), Region III-A Economic Development District and Regional Planning Commission (17%), East Central Indiana Regional Planning District (13%), Michiana Area Council of Governments (8%), Northeastern Indiana Regional Coordinating Council (NIRCC) (8%), Eastern Indiana Regional Planning Commission (3%), and Madison County Council of Governments (0.3%) (IARC, 2017).

NIRCC and the Region III-A Economic Development District and Regional Planning Commission completed a joint, comprehensive economic development strategy that addresses future economic and transportation needs for their 10 combined counties encompassing the northeast corner of the state (Region III-A , 2015). Though the City of Ft. Wayne is the dominant driver of growth in this area, the economic development strategy equally addresses the entire region which covers much of the eastern portion of the Upper Wabash SA.

According to the Northeast Indiana CEDS, as of 2013 there were a total of 309,927 people employed in the region, with Allen County accounting for slightly more than half of those jobs and the remaining counties accounting for between 4% and 7% each. The largest employment sector in the region is manufacturing with 71,783 (25%) of the workforce. The automotive sector accounts for 21.4% of manufacturing employment in this region including assembly, components fabrication, recreational vehicles and trailers. Other major manufacturing industries are the medical devices and defense industries in addition to steady growth in food processing due to significant row crop and livestock operations supported by major grain and processing. These products range from dairy, eggs, poultry, to specialty products, and have contributed to growth in agritourism, warehousing and distribution (Region III-A , 2015).

The six counties in the NCIRPC fall mostly within the SA, contributing to developed area with cities such as Kokomo, Frankfort, Logansport, Peru, Mexico and Rochester. Manufacturing is the dominant industry in the region accounting for 19.6% of the workforce with the top manufacturing being primary metals, fabricated metal products and machinery (NCIRPC, 2012). Other predominant work sectors include government (16.3%), retail/wholesale trade (13.7%), healthcare (9.1%), accommodation and food (6.6%) agricultural (4.5%), and transportation and warehousing (3.1%). Sectors with the most growth currently include agribusiness, biomedical, biotechnical and education, with other emerging sectors that include transportation and logistics, business and financial services, defense and security, as well as apparel and textiles (NCIRPC, 2012).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 17,034 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The Upper Wabash SA has the sixth greatest density of local road miles to square mile ratio of all SA's at approximately 2.46 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Upper Wabash SA contains approximately 2,834 miles of U.S. Interstates and highways, 4,430 miles of state highways, and 17,034 miles of local roads within its boundary (INDOT Road Inventory Section, 2016). Although this is the largest SA, the concentration of the road types per square mile of land varies in this SA.

U.S. Interstates and highways have a concentration of approximately 0.41 mile per square mile, which ranks seventh when compared to the other ten SAs making this the lowest ranking road type within the SA. Although the concentration of U.S. Interstates and highway miles per square mile ranks near the middle, the concentration of state roads ranks fourth with 0.64 mile per square mile. The concentration of local roads is approximately 2.46 miles per square mile, ranking sixth. Finally, the concentration of all roadways within the SA is 3.51 miles per square mile which gives it an overall ranking of sixth.

Although the concentration of U.S. interstates and highways and local roads rank near the middle, closer analysis reveals the concentration of state highways ranks within the top four when compared to all other SAs. The construction and maintenance of roads and bridges throughout the Upper Wabash SA will play an integral role in sustaining business and commerce for this region of the state.

2.5.2 Railroads

Railroads provide an alternative means of transportation with approximately 1,398 miles of railroad within the Upper Wabash SA (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Upper Wabash SA contains the seventh greatest concentration of railroads when compared to all SAs

with a density of 0.2 miles of railroad per square mile. The concentration of linear infrastructure throughout the SA poses a threat to aquatic resources in the form of habitat fragmentation, resource degradation, habitat conversion and resource loss.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Upper Wabash SA contains service corridors that contribute to aquatic resource impacts and habitat loss associated with linear infrastructure. The SA contains over 7,419 miles of service corridors within its boundary.

The Upper Wabash SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately 243 (12 kV) lines, fifty (34.5 kV) lines, thirty-two (69 kV) lines, 127 (138 kV) lines, fifty-four (230 kV) lines, thirty-two (345 kV) lines, and thirteen (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 2,506 miles throughout the SA, which ties for the ninth highest concentration of electric transmission lines relative to the SA size, resulting in 0.36 mile of transmission line per square mile.

In addition to electric transmission lines, the Upper Wabash SA contains over 1,784 miles of pipelines. It contains over 114 miles of pipelines that convey crude oil, 1,197 miles of pipelines that transport natural gas, and 473 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Upper Wabash SA contains the greatest concentration of natural gas, fifth greatest concentration of crude oil pipelines, and third greatest concentration of refined petroleum products pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 25 known low head dams (IDNR DOW, 2016) within the SA, the third highest among SA's, but eighth in concentration at one low head dam per 277 square miles. There are currently 46 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 150 square miles, the second lowest concentration of all SA's, but having 5% of all documented high head dams statewide.

Per the NLE GIS analysis (IDNR, 2016), there are approximately 638,880 linear feet (121 miles) of NLE's mapped within the SA, averaging one mile of NLE per 57 square miles, the third lowest concentration among all SA's. Blackford, Clinton, Delaware, Howard, Miami, Tipton and Wells counties within the SA were not included in the NLE identification project since they were not declared disasters resulting from the 2008 severe weather events; therefore, the Upper Wabash SA has additional NLE's that have not yet been mapped as part of this effort. Approximately 62 miles of the currently identified NLE's are located within predominantly developed areas with the remaining 59 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Natural Gas and Oil Production

The Upper Wabash SA contains a multitude of active oil and gas fields, along with associated wells that are currently supporting, or have supported, the petroleum industry within its boundary. The Indiana Geological Survey (IGS) identifies seven petroleum gas fields with 56 associated gas wells; seven oil fields with 178 oil wells; and three oil & gas fields with two oil & gas wells ranking the Upper Wabash SA eighth statewide for active natural gas and oil fields (Indiana Geological Survey, 2015).

The Upper Wabash SA also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 2,482 abandoned gas wells, 7,161 abandoned oil wells, 19 abandoned oil & gas wells, 1,909 dry wells, 67 observation wells, 168 stratigraphic wells, 32 saltwater injection wells, 40 abandon saltwater injection wells, four temporarily abandoned wells, and 26 non-potable water supply wells within the SA boundary (Indiana Geological Survey, 2015).

2.7.2 Mineral Mining and Aggregates

The Upper Wabash SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, the SA contains 18 sand & gravel mining operations, two peat mining operations, and 22 crushed stone operations (Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one slag operation, which is an industry byproducts commodity that is used as aggregate (Indiana Geological Survey, 2016). In addition to the Upper Wabash SA ranking first based on its size, mineral mining within its boundary ranks first in the state with 44 active operations.

2.7.3 Coal

The Upper Wabash SA does not have recoverable coal reserves and contains no active surface or underground coal mines.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Upper Wabash SA is located entirely within the Indiana SWAP Corn Belt Planning Region. The SWAP identifies the most significant threats to habitats and SGCN within the Corn Belt Region as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

The SWAP Corn Belt Region has experienced loss in the majority of habitat types over the last decade mostly to urban development, which gained 4.8% in land cover (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the agricultural and developed impervious footprints make up approximately 88% of the land cover of the SA and are expected to remain as top contributors to aquatic resource impairments.

IDNR expects development along with transportation and service corridor projects to remain the foremost permitted activities requiring mitigation for aquatic resource impacts if the 404 permitting trends of the past 7 years continue. Dam and/or levee activities accounted for the most wetland impacts over the analyzed timeframe, though future dam or levee rehabilitation or maintenance needs are not known at this time.

The NIRCC's 2035 Transportation Plan addresses needs and plans for the next two decades. Northeast Indiana is served by two major interstate highways, I-69 (North/South) and I-80/90 (East/West; Indiana Toll Road). The region is also crossed by seven U.S. highways and over twenty state roads. The interstate, U.S. highway, and state road systems provides connectivity throughout the region to nearly twenty major U.S. and Canadian markets within a 500 mile radius. Businesses in the region have a one-day drive by truck to more than 40% of the U.S. population and over one-fifth of the Canadian population. The roadway infrastructure, in addition to railroad access in the region, allow for significant intermodal transportation of freight in and out of the region. Roadways and associated infrastructure in the region are in need of maintenance to continue to provide the necessary services and connectivity for economic growth (NIRCC, 2013).

The economic goals and objectives for the NIRCC region include improving and diversifying workforce skill sets to attract more companies across all industries to include expanding the manufacturing core. Other regional planning goals include transportation and infrastructure investments, improved affordable energy, effective public transit, and increased shovel-ready development sites. The construction industry is projected to account for 5% of total economic growth by 2020, a 24.1% increase. There has been an emphasis on the development of trails and pedestrian facilities throughout the region. Public utilities are also underfunded and deteriorating, particularly sewer districts, and will require upgrades and ongoing repairs and maintenance (NIRCC, 2013).

The NCIRPC CEDS identifies economic growth and development goals that include: opportunities to expand workforce development; improvements to, and continued development of, cities; maximize the potential of air and highway transportation infrastructure; and provide improved infrastructure and services to residents and businesses (NCIRPC, 2012). This plan includes expansion and/or development of industrial parks, brownfield redevelopment, U.S. 24 and U.S. 31 corridor development

and infrastructure improvements, restore and expand housing prospects, attract industry management, create improved pedestrian modes of transportation and recreation, in order to attract families to relocate and stay within the region (NCIRPC, 2012).

The region has several geological resources including petroleum and mineral resources. The Trenton Oil Field is situated at the southeastern part of the region and has been a major petroleum source to the oil and gas industry in Indiana from the late 1800s to the early 1900s. Although most of the natural gas was removed from the field by 1910, only about 10% of the oil was removed with an estimated 900,000,000 barrels still remaining in the ground. The region also has a few places where minerals of commercial importance are mined. Most sand and gravel pits are located in Miami and Howard counties, while cement and crushed stone mines are clustered in the central part of the region. Biofuel crops and production are another significant contributor to the economy with the potential for future growth. Finally, the central and southern parts of the region have wind conditions that are especially favorable for potential wind farm development (NCIRPC, 2012).

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Upper Wabash SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Upper Wabash SA historic aquatic resources were comprised of a diverse mix of natural aquatic community types. Presettlement land cover was predominantly comprised of mixed forested communities. With the Upper Wabash SA boundary covering the majority of northern Indiana, the expansive forested communities that dominated the state were represented throughout the region. Similar to the majority of the state, the regions forests and aquatic resources were converted by early settlers in order to harvest timber and farm the land. During the mid-1800s, the land was cleared by immigrants in order to farm (Canal Society of Indiana, 2006).

Similar to the fate of the Black Swamp and the Great Kankakee Marsh, the Upper Wabash SA contained large wetland complexes that were impacted during this era. The Limberlost Swamp was a large wetland complex located near the eastern boundary of the SA. It covered approximately 13,000 acres and was known to be filled with diverse plants and wildlife (Inventorying the Loblolly Marsh, 2009). Unfortunately, the area was drained with a steam powered dredge from 1888 to 1910, creating the

Loblolly Ditch, in order to convert the area to farmland (Indiana Department of Natural Resources, 2017).

The Wabash-Erie Canal extended across the middle of the SA, from east to west, and provided an important transportation route that solidified commerce and settlements rooted in agriculture. Settlements were expanding throughout northern Indiana by 1840, predominantly along the route of the Wabash-Erie Canal (Carman, 2013). The construction of canals allowed settlers a means to get farmed commodities to markets. Eastern markets would pay higher prices for agricultural products and the canals provided transportation routes for these commodities, allowing for the shipping of European imports/exports and goods in and out of Indiana's interior (Canal Society of Indiana, 2006). Construction of this and other shipping routes led to the region's aquatic resources to be converted in order to sustain the agricultural and economic needs of the early settlers.

Due to extensive aquatic resource loss within the Upper Wabash SA, the understanding of the regions aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections and their natural aquatic communities within each respective Region and Section. **Figure 67**, depicts each Natural Region and Section located within the Upper Wabash SA and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss (**Table 57**). The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

Upper Wabash Service Area Natural Regions and Sections

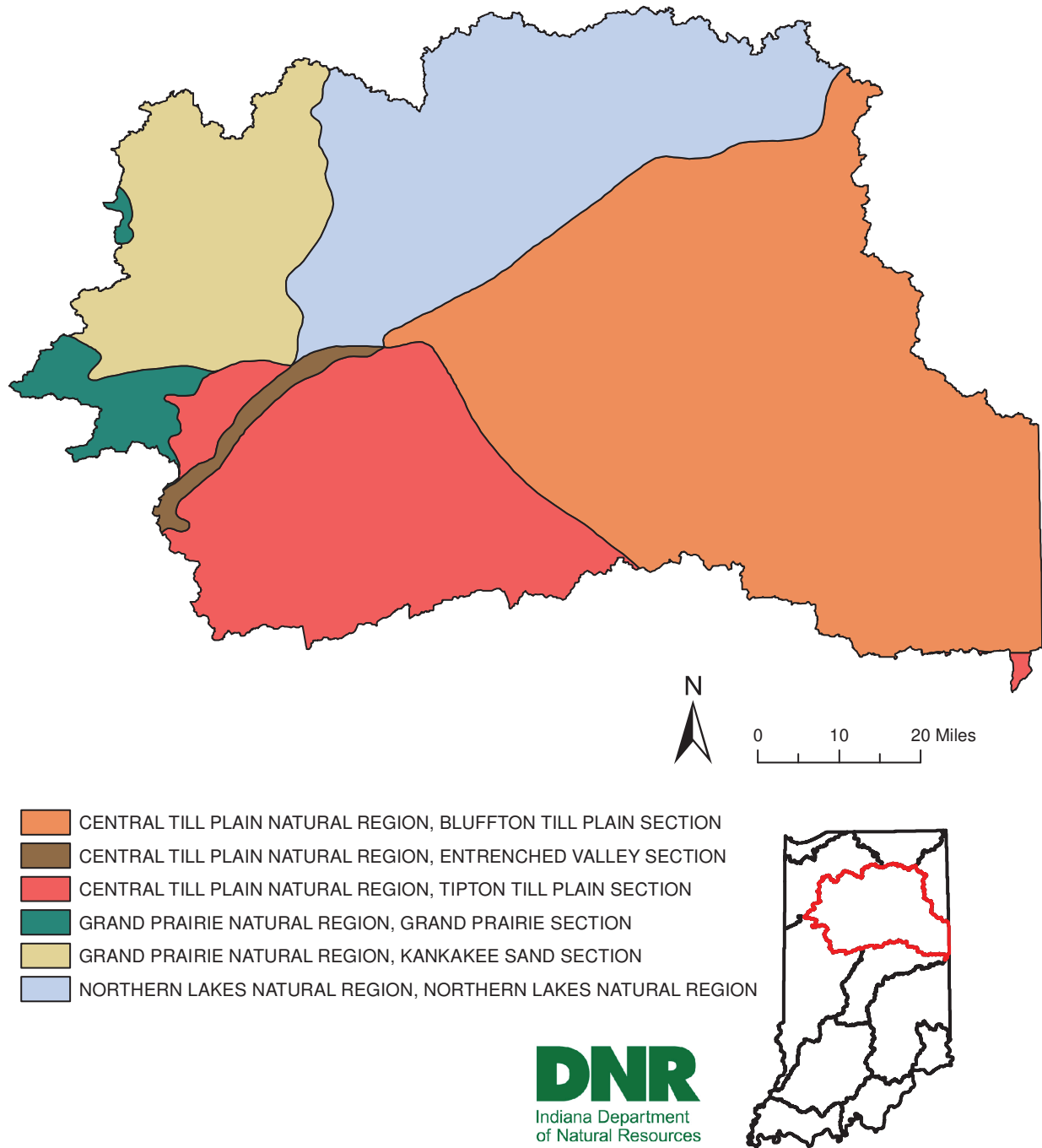


Figure 67. Natural regions and sections within the Upper Wabash Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

| Natural Region(s) | Natural Region: Section(s) | | Natural Region Community Types | Hydric Soils | | Partially Hydric | | Pre-Settlement % Forest Cover |
|--------------------|----------------------------|---------|--|--------------|---------|------------------|---------|-------------------------------|
| | Name | % Cover | | Acres | % Cover | Acres | % Cover | % Forested |
| Central Till Plain | Bluffton Till Pain | 44.5 | Predominantly forested; minor areas of bog, prairie, fen, marsh and lake | 1,206,158 | 27.26 | 1,253,152 | 28.32 | 88.33 |
| | Tipton Till Plain | 18.9 | Extensive beech-maple-oak forest (northern flatwoods) | | | | | |
| | Entrenched Valley | 1.07 | Predominantly upland forests, bottomland forests, and flatwoods; prairie, gravel-hill prairie, fen, marsh, savanna, cliff, seep spring, and pond; Typical streams medium-gradient, relatively clear, and rocky | | | | | |
| Grand Prairie | Kankakee Sand | 11.62 | Predominantly prairie and savanna; wet prairie, marsh, swamp, wet sand flat, and wet muck flat; predominantly oak forest (eastern), oak flatwoods (dunal swales) | | | | | |
| | Grand Prairie | 2.58 | Dry prairie, wet prairie, savanna, marsh, pond, bog (rare), and forest (riparian and oak groves); Typical streams low-gradient and silty | | | | | |
| Northern Lakes | Northern Lakes | 21.32 | Bog, fen, marsh, prairie, sedge meadow, swamp, seep spring, lake (Wet sand flats and muck flats), and various deciduous forest types; Typical streams are clear, medium to low-gradient, sandy gravel beds | | | | | |

Table 57. The historic natural community composition for the Upper Wabash Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 958 miles of category 4A impaired streams and 3,381 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (2,449 miles), PCBs in fish tissue (858 miles), impaired biotic communities (659 miles), nutrients (168 miles), dissolved oxygen (159 miles), and ammonia (66 miles) as current stream impairments with the SA (IR 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted 745 QHEI assessments reaches within the SA (**Table 58 and Figure 68**) (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 39.06% are capable of supporting a balanced warm water community.

| QHEI Score Ranges | Narrative Rating | Count | Percent of Total |
|-------------------|---|-------|------------------|
| <51 | Poor Habitat | 280 | 37.58 |
| 51-64 | Habitat is partially supportive of a stream's aquatic life design | 174 | 23.36 |
| >64 | Habitat is capable of supporting a balanced warm water community | 291 | 39.06 |
| | Total | 745 | 100% |

Table 58. IDEM Overall QHEI scores for Upper Wabash SA, 1991 – 2014 (IDEM OWQ, 2014)

Historically, sedimentation by hydromodification and nutrients from agricultural and urban runoff were the main causes of water quality issues within the Upper Wabash Service Area, especially along the Wabash River and its major tributaries. Hydromodification frequently causes streambank erosion, and sedimentation reducing aquatic habitat, spawning, and feeding areas for aquatic organisms. The Upper Wabash has the greatest amount of hydromodification of the SAs due to impoundments such as the Huntington, Salamonie, and Mississinewa Reservoirs as well as impoundments on the Tippecanoe River such as Lake Shafer and Freeman Lake. These impoundments have modified the natural flow regime of streams within the SA, often resulting in the degradation of stream banks and beds in addition to habitat alterations which significantly alters habitat for aquatic biota and decreases biodiversity.

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Upper Wabash SA ranks third least overall in forested cover density of all SA's at 9% of total SA with approximately 379,354 acres, and ranks sixth in forested cover of any SA at approximately 7.27% of 5,215,169 acres of forest cover statewide.

GIS analysis indicates that there are approximately 12,677,175 linear feet (2,401 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Upper Wabash SA is sixth among SA's in ratio of these potentially restorable stream miles to square miles of SA at approximately 0.35 mile of potential restoration per one square mile, or one mile of potential restoration for every 2.88 square miles of SA.

Upper Wabash Service Area Qualitative Habitat Evaluation Index (QHEI) Scores

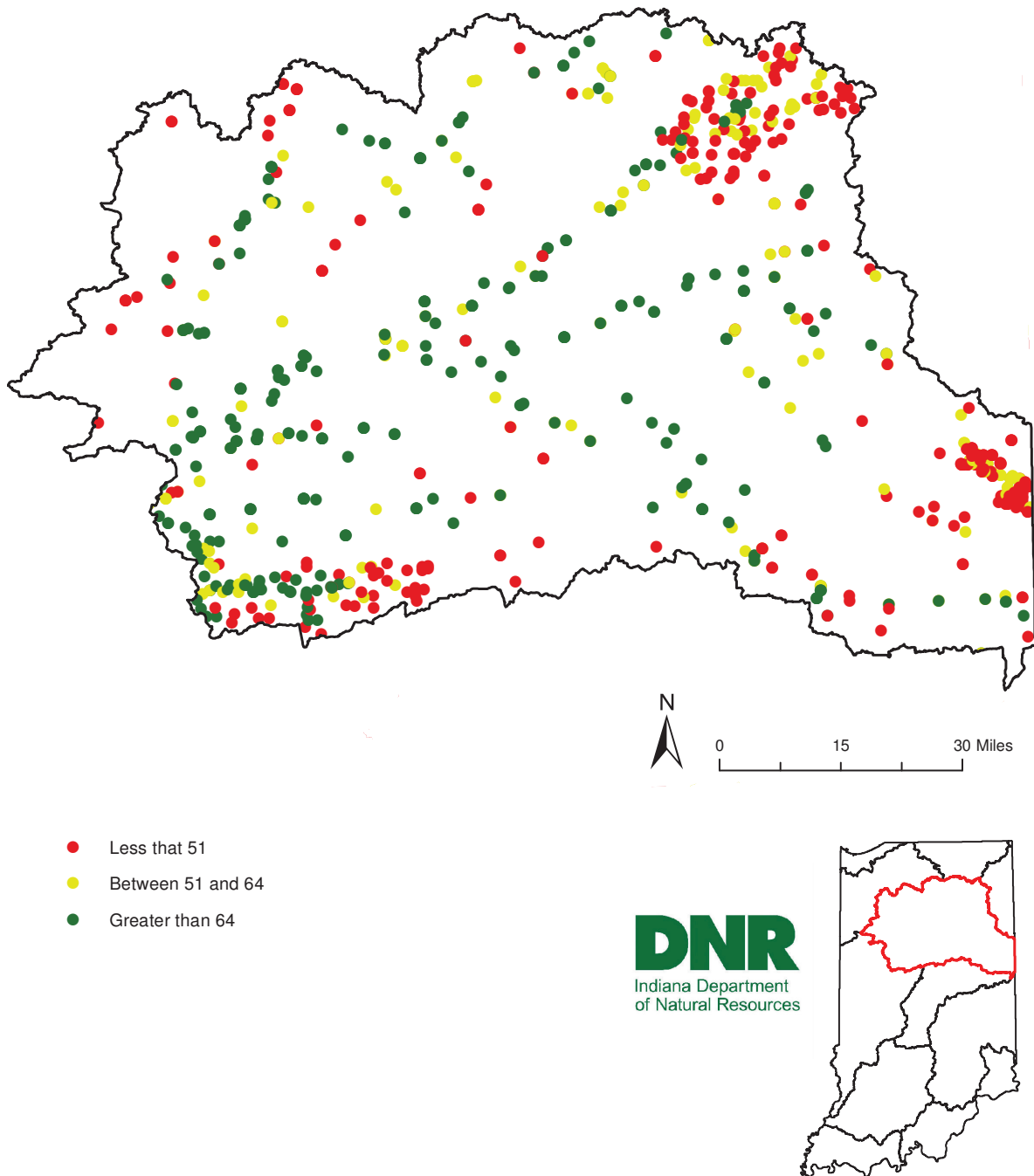


Figure 68. IDEM overall QHEI scores within the Upper Wabash service area; 1991-2014 (IDEM OWQ, 2014)

4.2 Wetlands

Analysis of the NWI in the Upper Wabash SA shows that there are approximately 34,575 acres of freshwater emergent wetland (PEM) and approximately 94,167 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 2.91% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 5.22% of the total SA (Table 59 and Figure 69).

| Aquatic Resource Type | Sum of NWI Aquatic Resource ACRES in SA | Percent of Total NWI Aquatic Resource Acres in SA | Percent of SA Total Acres | Percent of Total State Area –Acres |
|-----------------------------------|---|---|---------------------------|------------------------------------|
| Freshwater Emergent Wetland | 34,575 | 15% | 0.78% | 0.15% |
| Freshwater Forested/Shrub Wetland | 94,167 | 40.8% | 2.13% | 0.41% |
| Freshwater Pond | 16,069 | 7% | 0.36% | 0.07% |
| Lake | 38,645 | 16.7% | 0.87% | 0.17% |
| Riverine | 47,422 | 20.5% | 1.07% | 0.20% |
| Grand Total | 230,877 | 100.00% | 5.22% | 1.00% |

Table 59. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015)

Hydric and partially hydric soils (NRCS-USDA, 2016) account for 2,063,497 acres (Figure 70), or 46.63% land cover within the SA, out of which approximately 1,955,304 acres have the potential to be restored, accounting for 44.2% of the total SA. This was determined by mapping current hydric and partially hydric soils data with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Upper Wabash SA has the second highest percentage of recoverable wetland acres to total SA size of all SA's, and the most overall potentially restorable wetland acres of any SA. This is both due to a dominance of agricultural land uses and the Upper Wabash being the largest of all of the SA's.

Upper Wabash Service Area National Wetlands Inventory

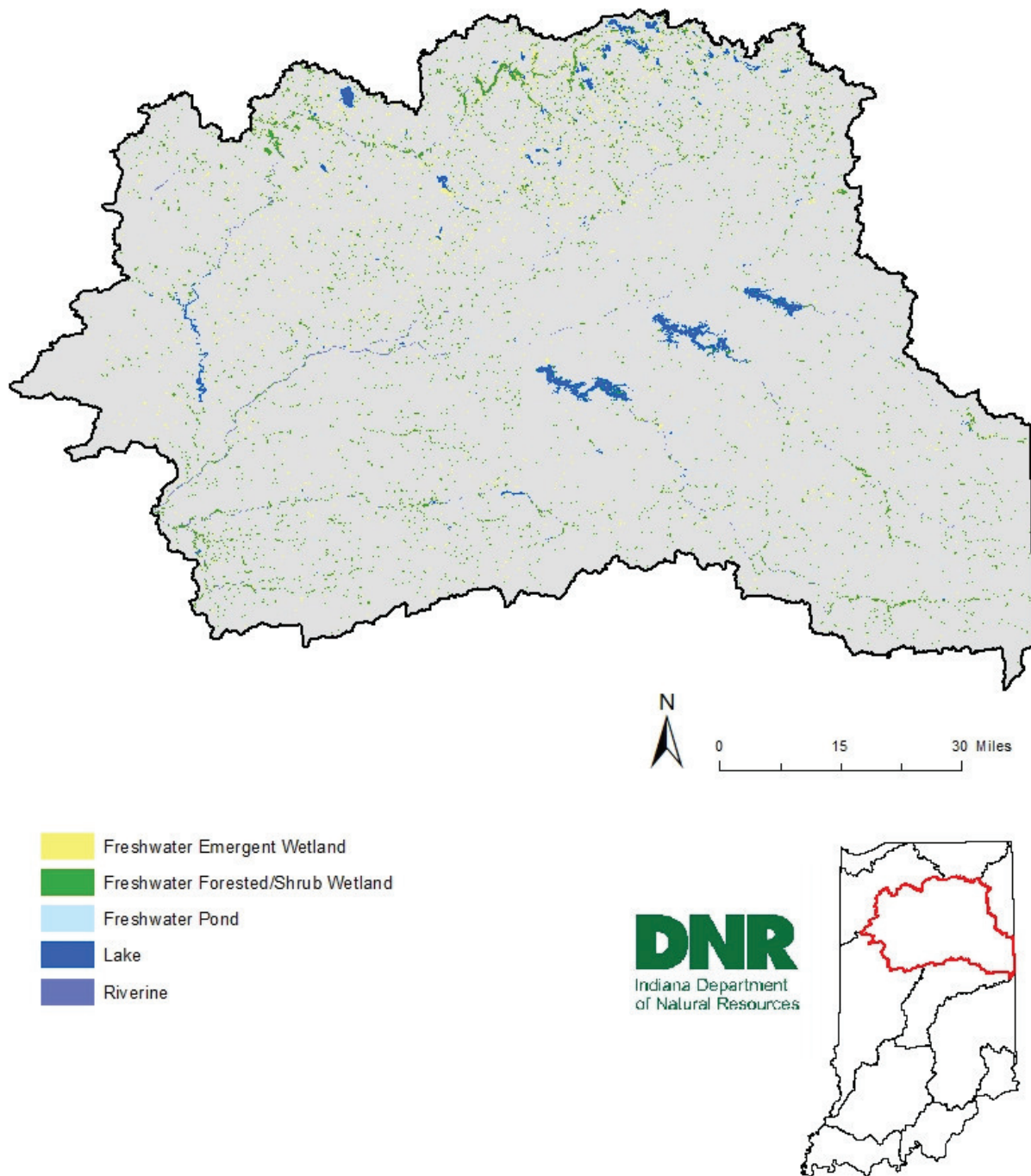


Figure 69. NWI for the Upper Wabash Service Area (USFWS NWI, 2015)

Upper Wabash Service Area Hydric Soils

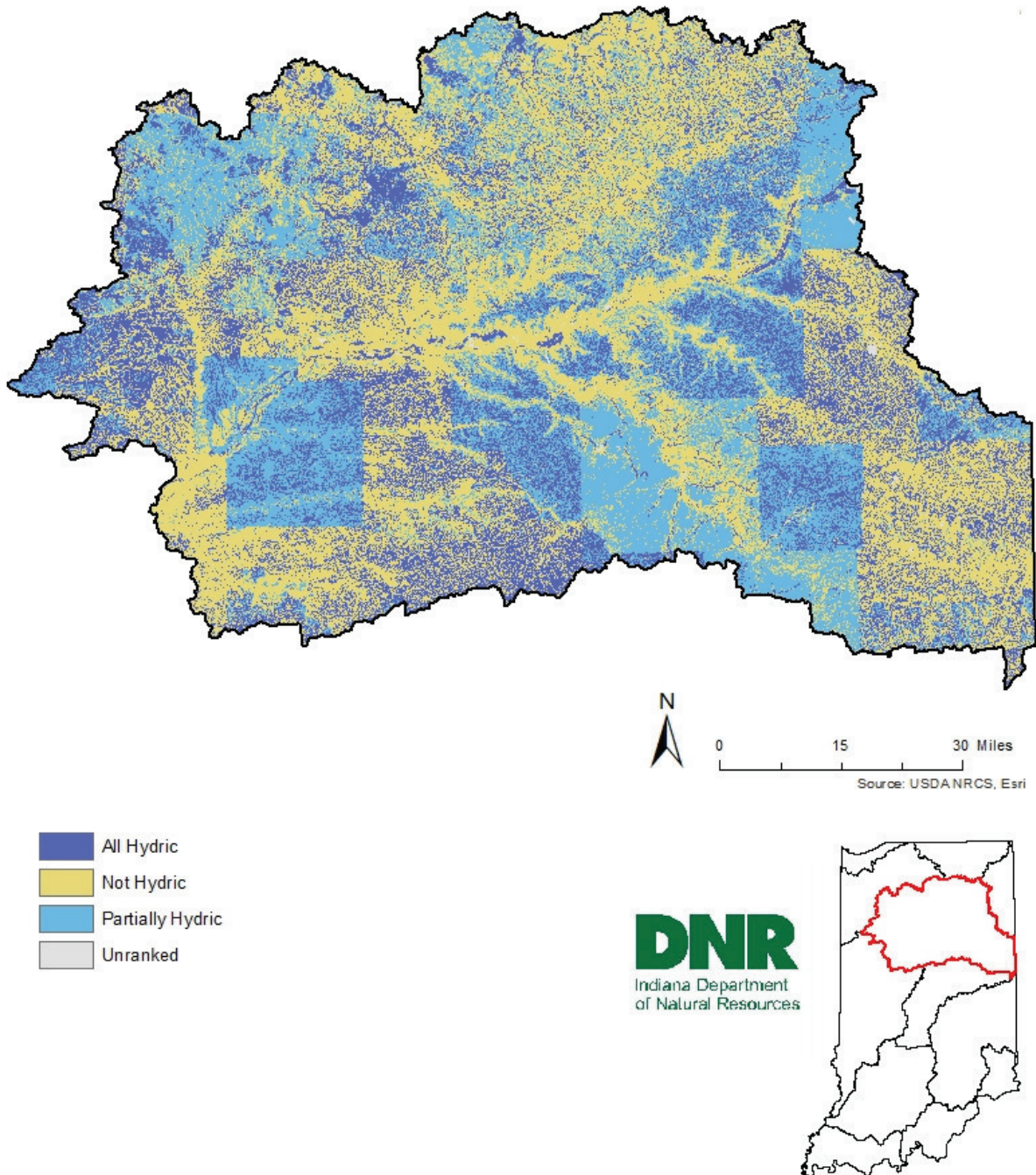


Figure 70. Hydric and partially hydric soils within the Upper Wabash Service Area (NRCS-USDA, 2016)

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 1,391,544 acres of these potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Pipe Creek (HUC 0512010115 [Table 60]).

Hotspots account for 5,290,560 linear feet of these potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Black Creek-Salamonie River (HUC 0512010203 [Table 61]). The watersheds with the highest concentrations of potentially restorable wetlands and streams (Tables 60 & 61) serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. Figure 71 shows where these watersheds are located within the SA.

Approximately 55,455 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands. Howat 80 Wildlife Management Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable wetlands (13,801 acres). Winamac Fish and Wildlife Area is the IDNR-managed land with the Upper Wabash SA with the most adjacent acres identified as hotspots of potential restorable wetlands, followed by Roush Lake Fish and Wildlife Area. There are approximately 6,716 linear feet of potentially restorable streams adjacent to IDNR-managed lands. Randolph County Wildlife Management Area is the IDNR-owned land with the most adjacent hotspots of potentially restorable streams (2,180 linear feet), followed by Loblolly Marsh Nature Preserve (1,401 linear feet).

| HUC 10 Code | HUC 10 Name | Hotspots of Potentially Restorable Wetlands (acres) |
|-------------|------------------------------|---|
| 0512010115 | Pipe Creek | 80,068 |
| 0512010505 | Deer Creek | 74,427 |
| 0512010610 | Big Monon Ditch | 68,384 |
| 0512010612 | Honey Creek-Tippecanoe River | 64,875 |
| 0512010701 | Kokomo Creek-Wildcat Creek | 67,036 |

Table 60. Watersheds in the Upper Wabash Service Area with the most hotspots of potentially restorable wetlands

| HUC 10 Code | HUC 10 Name | Hotspots of Potentially Restorable Streams (linear feet) |
|-------------|---------------------------------|--|
| 0512010203 | Black Creek-Salamonie River | 259,248 |
| 0512010201 | Brooks Creek-Salamonie River | 244,992 |
| 0512010104 | Loblolly Creek | 225,984 |
| 0512010405 | Paw Paw Creek-Eel River | 223,872 |
| 0512010305 | Massey Creek-Mississinewa River | 223,344 |

Table 61. Watersheds in the Upper Wabash Service Area with the most hotspots of potentially restorable streams

Upper Wabash Service Area

Concentrations of Potentially Restorable Streams and Wetlands

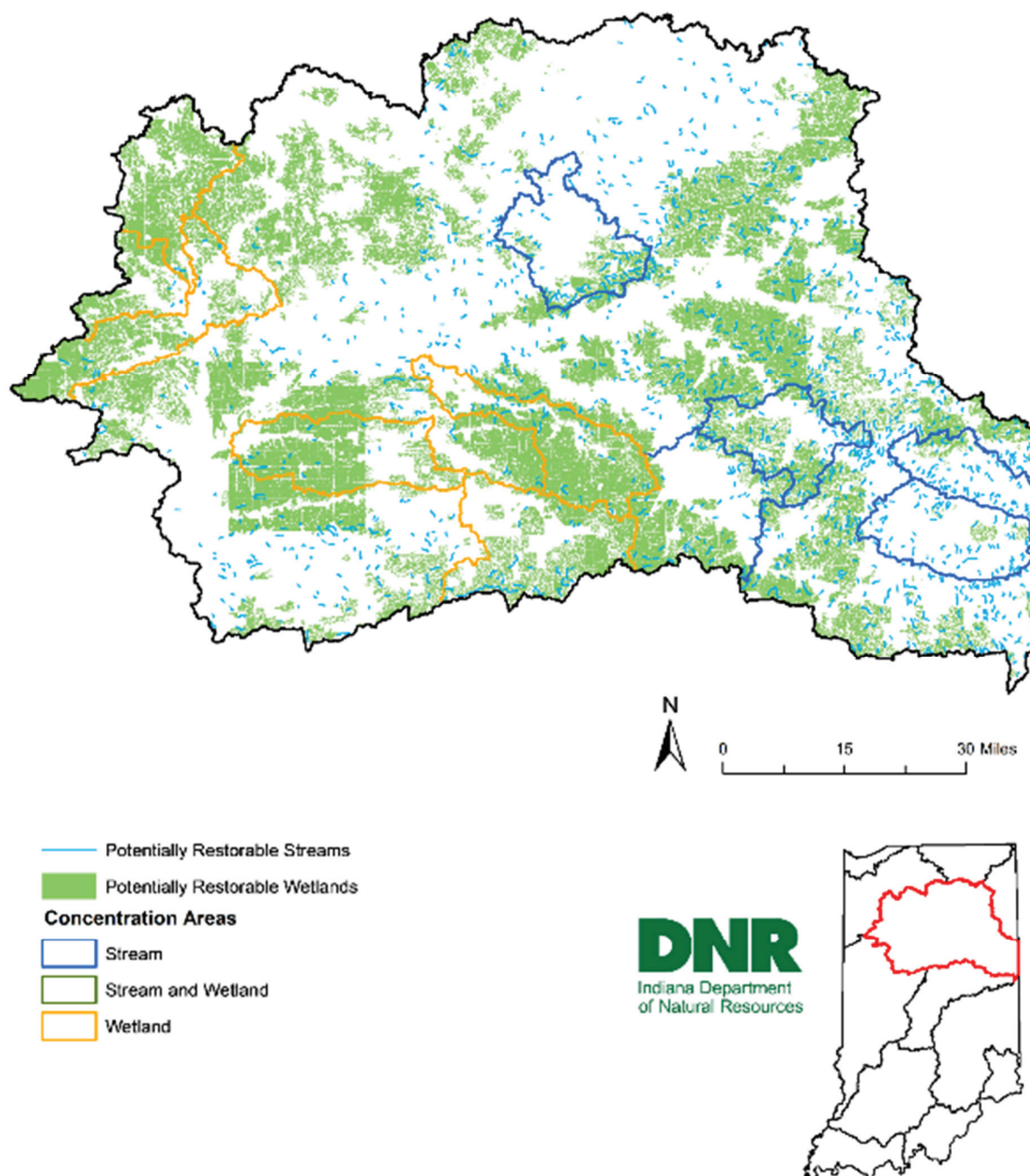


Figure 71. Concentrations of Potentially Restorable Streams and Wetlands in the Upper Wabash Service Area

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments (IDEM-IR, 2016) in the Upper Wabash SA indicates there are 39 lakes currently documented as having category 5 impairments, which measured using the National Hydrography Dataset (NHD) includes 12,317 acres with PCBs in fish tissue, and 3,064 acres with phosphorus, 709 acres with impaired biotic communities, 698 acres with E. coli, 291 acres with algae, and 77 acres with total mercury in fish tissue (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 39,035 acres of open water which accounts for 0.9% of the SA. This varies slightly from the NWI, which identifies approximately 16,069 acres of freshwater ponds comprising 0.4% of the SA, and 38,645 acres of lakes comprising 0.9% of total SA acres. Of these open waterbodies, GIS analysis identifies approximately 120 natural public freshwater lakes (PFL) (IC 14-26-2-1.5) within the SA, which is 28% of the PFL's as identified by the Indiana Natural Resource Commission list of public freshwater lakes as of June 2011 (IN NRC, 2011). Furthermore, GIS analysis indicates that approximately 3,450 acres of PFO, PSS and/or PEM from the NWI that are contiguous with the boundary of PFL's within the SA as identified in the DNR DOW's GIS data (IDNR DOW PD, 2016).

Shorelines of the natural lakes within the Upper Wabash SA, especially within the Tippecanoe Watershed (HUC-05120106), have been altered by humans resulting in the loss of important lacustrine wetland areas. These alterations were caused by a variety of activities such as road construction and residential development. As a result of these alterations, natural areas have been fragmented and biodiversity has been significantly reduced. This decrease in diversity and productivity has ultimately caused a decrease in the health of aquatic ecosystems existing within lacustrine wetlands; human activities have proven to be primarily responsible for the degradation of plant communities, wildlife habitat, and water quality of these wetlands (Price, 2009).

IDNR will remain up to date with PFL and reservoir condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Upper Wabash SA shows that approximately 97% of the shallow unconsolidated aquifers receive between 3 to 8 inches of ground water recharge annually (**Table 62**).


| Recharge Rate | Inches/Year | Square Miles | Percent of Calumet-Dunes SA |
|--|-------------|--------------|-----------------------------|
| <div>High</div>  <div>Low</div> | 14 | 0.23 | 0.003% |
| | 13 | 0.29 | 0.004% |
| | 12 | 1 | 0.02% |
| | 11 | 10 | 0.15% |
| | 10 | 7 | 0.10% |
| | 9 | 37 | 0.54% |
| | 8 | 252 | 3.65% |
| | 7 | 654 | 9.46% |
| | 6 | 1,107 | 16.01% |
| | 5 | 1,746 | 25.26% |
| | 4 | 1,804 | 26.09% |
| | 3 | 1,120 | 16.20% |
| | 2 | 148 | 2.14% |
| | 1 | 26 | 0.38% |

Table 62. Approximate ground water recharge rates in the Upper Wabash SA (Letsinger S. L., 2015)

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that over 99% of the Upper Wabash SA near surface aquifers fall between low to high sensitivity to contamination, with nearly 50% being moderate (**Table 63**). The aquifer sensitivity reflects the aquifer recharge rates for the SA.

| Sensitivity | Square Miles | Percent of Total Acre |
|-------------|--------------|-----------------------|
| Very High | 22 | 0.32% |
| High | 1,909 | 28% |
| Moderate | 3,221 | 47% |
| Low | 1,760 | 25% |
| Very Low | 3 | 0.04% |

Table 63. Ground water sensitivity distribution in the Upper Wabash Service Area (Letsinger S. , 2015)

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data shows the Upper Wabash SA is eighth among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 22,272 MGD (**Figure 72**) (IDNR DOW, 2016). Industry accounts for approximately 65% of registered withdrawal capacity followed by energy production with 25%, and public water supply with 8%.

Upper Wabash Service Area 2015 Surface Water Use (Million Gallons Per Day)

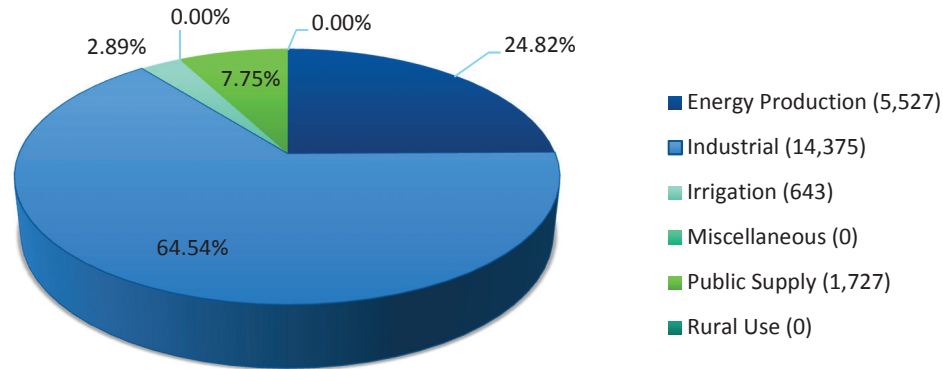


Figure 72. 2015 surface water usage in the Upper Wabash Service Area (IDNR DOW, 2016)

Significant ground water withdrawal in the Upper Wabash SA is the third most of any SA with a 28,359 MGD registered capacity (**Figure 73**). Public water supply accounts for approximately 56% of registered ground water withdrawal capacity in the SA, followed by agricultural irrigation with 24%, industry with 15% and energy production with 4%.

Upper Wabash Service Area 2015 Groundwater Use (Million Gallons Per Day)

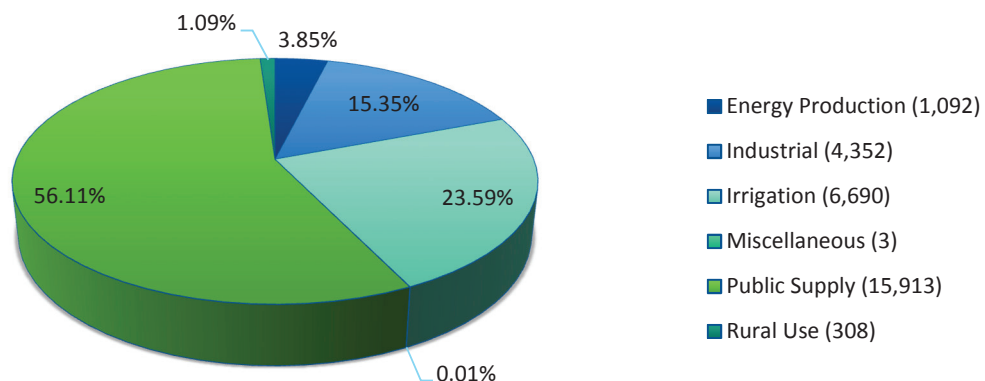


Figure 73. 2015 ground water usage in the Upper Wabash Service Area (IDNR DOW, 2016)

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, other high quality natural communities currently documented in the Natural Heritage Database within the Upper Wabash SA include, but are not limited to acid bog, circumneutral bog, circumneutral seep, fen, forested fen, flatwoods, marsh, sedge meadow, shrub swamp, wet-mesic floodplain forest, wet prairie, wet sand prairie, and marl beach, in addition to many other transitional, mixed and upland communities.

There are currently six amphibian species, 47 bird species, seven fish species, 14 mammal species, 15 mollusk species, and seven reptile species listed as SGCN within the Indiana SWAP Corn Belt Planning Region (SWAP, 2015) which includes the Upper Wabash SA.

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Upper Wabash SA. The following aquatic resource goals and objectives apply specifically to the Upper Wabash SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and/or preservation of aquatic resources that will help offset current and anticipated threats within the SA.
2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships).
4. Restoration of riparian and lacustrine wetlands to buffer from threats and improve functions and services in the pursuance of aquatic resource connectivity of formally extensive wetland and natural lake complexes throughout the SA that have been diminished and/or lost to conversion.
5. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
6. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
7. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt Plains Planning Region where feasible.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following core criteria shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Upper Wabash SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

Currently, the following watershed plans exist within the SA: Eel River-Tick Creek WMP, Eel River (middle) WMP, Limberlost-Loblolly WMP, Upper Wabash River WMP, Mud Creek Headwaters WMP, Pete's Run WMP, Stahl Ditch-Kitty Run WMP, Turkey Creek/Askren/Round Prairie Creek WMP, and Upper Tippecanoe River WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Upper Wabash SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and important habitat for SGCN while addressing the important physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in conjunction with the primary objective of restoration to be determined on a per project basis and approved by the DE.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Woodland Savanna Land Conservancy, Trillium Land Conservancy, Wawassee Area Conservation Fund, Little River Wetlands Project, Wood-Land-Lakes RC&D Council, ACRES Land Trust, NICHES Land Trust, Red-tail Conservancy, and Central Indiana Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program

Additional stakeholders' interest and potential conservation partnerships specific to the Upper Wabash SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- Wabash River Heritage Corridor Commission
- Upper Midwest and Great Lakes, and Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperatives
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Municipal and County governmental entities
- Active Watershed Groups and appropriate Watershed Management Plans
- Region III-A Economic Development District & Regional Planning Commission
- Northeastern Indiana Regional Coordinating Council
- Northcentral Indiana Regional Planning Council (NCIRPC)
- East Central Indiana Regional Planning District
- Eastern Indiana Regional Planning Commission
- Madison County Council of Governments
- Kankakee-Iroquois Regional Planning Commission
- Michiana Area Council of Governments (MACOG)
- Indiana Lakes Management Society
- Wabash River Watershed Section 729 Watershed Assessment – USACE Louisville District
- The Watershed Foundation – Upper Tippecanoe River Watershed
- Little River Wetlands Project
- Mississippi River Basin Initiative

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 74** below.

Upper Wabash River Service Area High Priority Aquatic Resource Conservation Sites

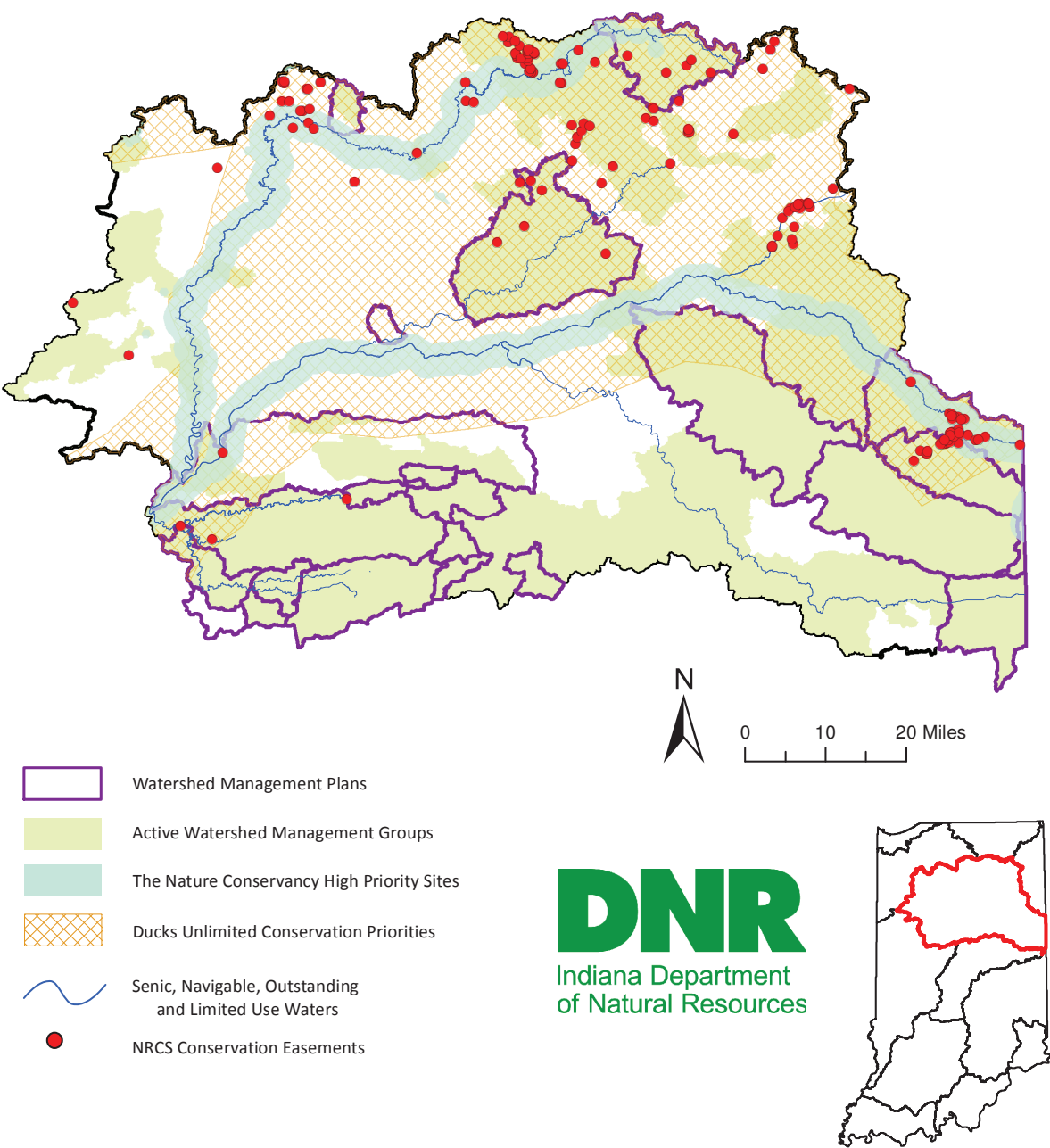


Figure 74. Priority aquatic resource conservation groups and sites within the Upper Wabash Service Area (IWPP, 2015)

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.